National Institute of Environmental Health Sciences

Characterization of PM2.5 aerosols dominated by local pollution and Asian dust observed at an urban site in Korea during Aerosol Characterization Experiments (ACE)-Asia project

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Abstract:

Daily fine particulate matter (PM2.5) samples were collected at Gwangju, Korea, during the Aerosol Characterization Experiments (ACE)-Asia Project to determine the chemical properties of PM2.5 originating from local pollution and Asian dust (AD) storms. During the study period, two significant events occurred on April 10-13 and 24-25, 2001, and a minor event occurred on April 19, 2001. Based on air mass transport pathways identified by back-trajectory calculation, the PM2.5 dataset was classified into three types of aerosol populations: local pollution and two AD aerosol types. The two AD types were transported along different pathways. One originated from Gobi desert area in Mongolia, passing through Hunshandake desert in Northern Inner Mongolia, urban and polluted regions of China (AD1), and the other originated in sandy deserts located in the Northeast Inner Mongolia Plateau and then flowed southward through the Korean peninsula (AD2). During the AD2 event, a smoke plume that originated in North Korea was transported to our study site. Mass balance closures show that crustal materials were the most significant species during both AD events, contributing ~48% to the PM2.5 mass; sulfate aerosols (19.1%) and organic matter (OM; 24.6%) were the second greatest contributors during the AD1 and AD2 periods, respectively, indicating that aerosol properties were dependent on the transport pathway. The sulfate concentration constituted only 6.4% (4.5 μg/m3) of the AD2 PM 2.5 mass. OM was the major chemical species in the local pollution-dominated PM2.5 aerosols, accounting for 28.7% of the measured PM2.5 mass, followed by sulfate (21.4%), nitrate (15%), ammonium (12.8%), elemental carbon (8.9%), and crustal material (6.5%). Together with substantial enhancement of the crustal elements (Mg, Al, K, Ca, Sc, Ti, Mn, Fe, Sr, Zr, Ba, and Ce), higher concentrations of pollution elements (S, V, Ni, Zn, As, Cd, and Pb) were observed during AD1 and AD2 than during the local pollution period, indicating that, in addition to crustal material, the AD dust storms also had a significant influence on anthropogenic elements. Copyright 2007 Air & Waste Management Association.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Extreme Weather Event

Air Pollution: Particulate Matter, Other Air Pollution

Air Pollution (other): SOx; NOx; trace metals

Extreme Weather Event: Other Extreme Event

Extreme Weather Event (other): dust storm

Geographic Feature: ☑

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: South Korea

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified